

REVIEW OF THE UPDATED 2002 SABLEFISH STOCK ASSESSMENT

Panel Members:

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Overview:

Schirripa and Methot (2001) completed a stock assessment of west coast sablefish, which was formally reviewed in Newport, OR by a complete STAR panel (Brodziak *et al.* 2001). Following completion of the review, information was presented that indicated a high abundance of sablefish in the 2001 AFSC shelf trawl survey. Based on the importance of this new information, the Pacific Fishery Management Council (PFMC), while utilizing the 2001 assessment to establish management measures for 2002, decided to undertake an update of the 2001 assessment in 2002. The PFMC also adopted Terms of Reference for Expedited Stock Assessment Updates (Appendix 1), to accommodate an expedited form of review. The Terms of Reference apply to situations where a "model" has already been critically examined and the objective is to simply update it by incorporating the most recent data.

Schirripa (2002) presented an update to the sablefish stock assessment using data recently made available. His results show that the 1999 and 2000 year-classes appear to be relatively strong, based on incorporation of the data from: (1) the 2001 AFSC shelf trawl survey, (2) the 2001 R/V Miller Freeman AFSC slope trawl survey, and (3) the NWFSC Industry Cooperative survey. In addition, the updated assessment estimates the slope trawl survey catchability coefficient (Q) to be lower than it was estimated to be in 2001.

List of Analyses Requested by the Review Panel:

Following completion of the May 6, 2001 sablefish STAR panel teleconference, the review panel Chair submitted three requests to Dr. Schirripa to clarify aspects of his analysis (e-mail dated Monday, May 6, 3:55 PM). These were (in priority order):

1. Conduct a sensitivity analysis and associated projections in which the selectivity block for 2001 is omitted, the selectivity for 2001 is assumed to be the same as that for 1998-2000, and any "emphasis" removed from the 2001 commercial length composition data. The panel made this request because it was concerned that the new selectivity block may have strongly influenced the estimate of 2001 recruitment and hence all the projections.
2. Place confidence intervals on the figures (e.g. Figures 17 and 18) that show the fit of the model to survey estimates of biomass .
3. Time permitting, compare the "density-dependent" projections based on model 6 (columns 2 & 3 in Table 4a), which resample recruits from those for 1992-98, with projections that resample recruits from those for 1992-2001. The panel anticipated that the revised projections would be more optimistic.

Dr. Schirripa responded with an e-mail (dated Tuesday, May 7, 11:23 AM) with an attached updated document (sable02_v11.exe ==> sable02_v11.pdf), that included responses to all three requests. With respect to the first item, the panel noted that differences between model 6A (the STAT team's original model with a new 2001 selectivity block) and model 6B (a model without a distinct 2001 selectivity block, but with the 2001 fishery length data down-weighted) were relatively minor (i.e., 5% increase in ending biomass, an 8% increase in 2003 catch). This finding was reassuring to the panel, which was concerned that incorporating a new 2001 selectivity block might influence the spawner-per-recruit (SPR) and $F_{45\%}$ calculations. An increase in the selectivity of young fish would tend to reduce the full-recruitment F to maintain SPR at 45%. A slightly lower catch when F_{SPR} is calculated using the 2001 blocked selectivity curve is consistent with this.

The available evidence indicates that the new minimum size regulation for sablefish resulted in a change in the retention of small fish, not a more fundamental change in selectivity. However, it was not possible to model a change in retention because: (1) discard estimates for 2001 are not yet available, (2) there is no information on the size composition of discards that would allow re-estimation of the retention curve. Essentially, Model 6 attempts to get around the lack of discard data. While the panel doesn't actually believe that selectivity changed, by adding extra selectivity parameters the assessment team was able to model away the information content of the 2001 fishery compositional data so that it had little influence on the model fit to other data.

In the original assessment document the STAT team provided results for a model fit to the new data, but with slope survey Q fixed at the value estimated by Schirripa and Methot (2001). Following the teleconference, the panel engaged in considerable e-mail discussion concerning the merits of fixing or re-estimating the slope survey Q parameter. Results in Table 2 show that most of the change in Q resulted from the addition of the 2001 slope survey length composition. The 1999 year class was much more available to the 2001 shelf trawl survey than to the slope survey (Figs. 19 and 20). This resulted in a marked change in the selectivity of age-1 fish in the slope trawl survey (Table 2, Fig. 23). The decreased availability of very young fish to the slope survey resulted in a lowering of Q .

The 2001 STAR panel also considered the pros and cons of estimating catchability for the slope trawl survey within the assessment model, ultimately electing to do so (Brodziak *et al.* 2001). They state:

"The STAT team provided information on uncertainty in slope survey catchability (Q) for the baseline models, although most baseline assessment models (3A-3F) assumed that the slope survey catchability was fixed at a value of $Q=0.75$. The panel asked that Q be estimated and that the uncertainty in slope survey catchability be characterized."

"the estimated value of the slope survey Q was quite variable as evidenced by the flatness of the likelihood function over large range of Q s. Thus there remained a large degree of uncertainty in current stock biomass."

Given the more detailed and deliberate exploration of this issue by the 2001 review panel and the Terms of Reference for Expedited Stock Assessment Updates (Appendix 1), which dictates that in a stock assessment update the baseline model structure should be left intact to the greatest extent practicable, the panel ultimately decided that fixing Q based on the 2001 assessment was inappropriate. However, it should be noted that in the 2001 assessment the estimated value of Q (0.601) was reasonably consistent with the previously fixed value of 0.75, which may have played a role in its acceptance, despite being poorly determined. In addition, Brodziak *et al.* (2001) were confronted with two distinct and disparate sablefish models (i.e., Schirripa and Methot [2001] and

Hilborn *et al.* [2001]); estimation of Q within the two models was one way to achieve an melding and standardization of assessment results. This likely influenced the decision of the 2001 STAR panel to recommend that Q be estimated internally, rather than being fixed at a value of 0.75.

Comments on the Technical Merits of the Updated Stock Assessment:

The review panel found the updated assessment (Schirripa 2002) to be technically sound and to represent the best available scientific information regarding the status of the sablefish resource along the U. S. west coast. Importantly, the updated stock assessment followed closely the analysis presented in Schirripa and Methot (2001). While not formally incorporated into the assessment model, the panel found the discussion of (1) sablefish bycatch in the Pacific whiting fishery and (2) the relationship between sablefish year-class strength and sea-level anomalies to be illuminating and useful. These two auxiliary analyses provided supplemental information in support of the conclusion that sablefish reproductive success has improved substantially since 1998.

Explanation of Areas of Disagreement:

There were no substantial areas of disagreement among the members of the review panel and the assessment author. The principal difficulty encountered during the review was how to interpret a major change in slope survey catchability (see above and below). Nonetheless, the panel did reach consensus that re-estimation of this parameter was consistent with the findings and philosophy of the previous STAR panel (Brodziak *et al.* 2001) and that there was no *a priori* reason to presume that the re-estimated value was inferior to the original number, given that it was based on additional data.

A further area of discussion centered around the year-classes on which the “density-dependent” projections (see item 3 above) should be based. The recruitments in the next few years for such projections should be expected to be most similar to the most recently observed recruitments because that “density-dependent” scenario is based on the assumption that recruitment is directly linked to spawning biomass, and spawning biomass is not apt to change markedly in the next few years. Following the recommendation of the review panel the “density-dependent” projections were therefore altered to include the 1999-2001 year-classes (Table 4D). When considering the “density-dependent” hypothesis, the panel favored the use of the latter projections over those presented in Table 4A.

Although four types of projections are presented for Model 6, it is reasonable to down-weight two of them as internally inconsistent. Specifically, results from Model 6 using a density-dependent target ($B_0 = 220,931$ based on 1975-1991 recruitments), but a regime shift pool of recruitments for projection (1975-2001 year-classes), are self-contradictory. Likewise, results employing a regime shift target ($B_0 = 178,603$ based on 1975-2001 recruitments), but a density-dependent pool of recruitments for projection (1992-2001) are not consonant. When considering either of these alternative states of nature, both the virgin biomass estimate and the recruitment pool used for projections should be consistent with the hypothesis under question.

Recommendation Regarding the Adequacy of the Updated Assessment for Use in Management:

With certain reservations and caveats, the panel endorses the use of Model 6 for management of the west coast sablefish stock in 2003 and into the future (see Table 1 below). However, the panel strongly believes that decision-making based on that analysis, which estimates the catchability coefficient (Q) of the slope trawl survey as a part of the model-fitting process, is not without considerable risk due to uncertainty in the estimate of current and historical stock size. Specifically:

- (1) The difference in estimated Q values (0.601 last year versus 0.460 this year) has a very large impact on the estimate of exploitable stock size (107,000 mt last year versus 155,000 mt this year (Table 2).
- (2) The lower Q value translates into a dramatic change in the potential range of OYs (3,877-4,630 mt last year [Table 3] versus 7,640-8,437 mt this year [Table 4A]).
- (3) The estimate of Q remains very imprecise (although less so than was the case in 2001; see Figure 24). Consequently, it is subject to change due to slight modifications to the data used in the assessment. Although it is not possible to determine whether the re-estimated value is superior to the original (i.e., it is closer to the truth), because it is based upon more data it should not be expected to be worse.
- (4) When B_0 and the projections are based on the assumption of density-dependence in the stock-recruitment relationship (one of four cases considered), even Model 6 predicts that harvests based upon the default 40:10 rule will drive the resource towards the overfished threshold of $0.25 B_0$ (Table 4D, repeated below).
- (5) If all the new landings and survey information are updated, but Q is fixed at the value estimated in the 2001 assessment (results presented as Model 7 [Table 5A]), the 2003 OY is reduced from the Model 6 value by 28.4% (8,437 to 6,037 mt) under the “regime shift” hypothesis and 31.4% under the “density-dependent” hypothesis (7,640 to 5,236 mt). Nevertheless, these 2003 OYs remain higher by 43% and 34%, respectively, than the corresponding 2003 OY’s from the 2001 assessment.

Given that (1) Q is poorly determined and that (2) at this time there is no compelling scientific basis to select between the two states of nature (density-dependent versus regime shift), the review panel concluded that a precautionary adjustment that would lower the “risk neutral” sablefish OY is warranted, in order to reduce the possibility of over-harvesting the resource. While, the amount of the adjustment is a policy decision appropriately left to managers, an increased level of precaution is generally indicated in situations where uncertainty is great.

Table 1. – “Risk-neutral” projections of the west coast sablefish stock under Model 6 using the density-dependent and regime shift hypotheses.

Year	Density-Dependent		Regime Shift	
	SSB/ B_0	40:10 OY	SSB/ B_0	40:10 OY
2003	0.31	7,682	0.39	8,437
2004	0.32	7,786	0.39	8,620
2005	0.32	7,761	0.40	8,777
2006	0.32	7,634	0.40	8,889
2007	0.32	7,444	0.41	8,960
2008	0.32	7,221	0.41	9,017
2009	0.31	6,987	0.42	9,066
2010	0.31	6,760	0.42	9,108
2011	0.30	6,552	0.42	9,147
2012	0.30	6,362	0.43	9,182

References:

- Brodziak, J., R. Cook, S. Gavaris, J. Golden, A. Hoffman, R. Moore, S. Ralston, and M. Saelens. 2001. Sablefish STAR Panel Report, Hatfield Marine Science Center, Newport, OR, July 13-16, 2001. Pacific Fishery Management Council, 7700 NE Ambassador Place, Suite 200, Portland, OR 97220-1384.
- Hilborn, R., J. L. Valero, and M. Maunder. 2001. Status of the sablefish resource off the U. S. Pacific coast in 2001. Pacific Fishery Management Council, 7700 NE Ambassador Place, Suite 200, Portland, OR 97220-1384.
- Schirripa, M. J., and R. Methot. 2001. Status of the Sablefish Resource off the U. S. Pacific Coast in 2001 (version 1.6; August 10, 2001). Pacific Fishery Management Council, 7700 NE Ambassador Place, Suite 200, Portland, OR 97220-1384.
- Schirripa, M. J. 2002. Status of the Sablefish Resource off the Continental U. S. Pacific Coast in 2002 (version 1.1; May 7, 2002). Pacific Fishery Management Council, 7700 NE Ambassador Place, Suite 200, Portland, OR 97220-1384.

Appendix 1: Terms of Reference for Expedited Stock Assessment Updates

While the ordinary STAR process is designed to provide a general framework for obtaining a comprehensive, independent review of a stock assessment, in other situations a less rigorous review of assessment results is desirable. This is especially true in situations where a “model” has already been critically examined and the objective is to simply update the model by incorporating the most recent data. In this context a model refers not only to the population dynamics model *per se*, but to the particular data sources that are used as inputs to the model, the statistical framework for fitting the data, and the analytical treatment of model outputs used in providing management advice, including reference points, the allowable biological catch (ABC) and optimum yield (OY). When this type of situation occurs, it is an inefficient use of scarce personnel resources to assemble a 6 person panel for a whole week to evaluate an accepted modeling framework. These terms of reference establish a procedure that can accommodate an abbreviated form of review for stock assessment models that fall into this latter category. However, it is recognized that what in theory may seem to be a simple update, may in practice result in a situation that is impossible to resolve in an abbreviated process. In these cases, it may not be possible to update the assessment – rather the assessment may need to be revised in the next full assessment review cycle.

Qualification

The Scientific and Statistical Committee (SSC) will determine when a stock assessment qualifies for an expedited update under these terms of reference. To qualify, a stock assessment must carry forward its fundamental structure from a model that was previously reviewed and endorsed by a full STAR panel. In practice this means similarity in: (a) the particular sources of data used, (b) the analytical methods used to summarize data prior to input to the model, (c) the software used in programming the assessment, (d) the assumptions and structure of the population dynamics model underlying the stock assessment, (e) the statistical framework for fitting the model to the data and determining goodness of fit, (f) the weighting of the various data components, and (g) the analytical treatment of model outputs in determining management reference points, including F_{msy} , B_{msy} , and B_0 . It is the SSC’s intention to employ an expedited stock assessment update in situations where no significant change in these 7 factors has occurred, other than extending time series of data elements within particular data components used by the model, e.g., adding information from a recently completed survey with an update of landings. In practice there will always be valid reasons for altering a model, as defined in this broad context, although, in the interests of stability, such changes should be resisted when possible. Instead, significant alterations should be addressed in the next subsequent full assessment and review. In principle, an expedited update is reserved for stock assessments that maintain fidelity to an accepted modeling framework, but the SSC does not wish to prescribe in advance what particular changes may or may not be implemented. Such a determination will need to be made on a case by case basis.

Composition of the Review Panel

The groundfish subcommittee of the SSC will conduct the review of an expedited stock assessment update. A review panel chairman will be designated by the chairman of the groundfish subcommittee from among its membership and it will be the panel chairman’s responsibility to insure the review is completed properly and that a written report of the proceedings is produced. Other members of the subcommittee will participate in the review to the extent possible, i.e., input from all members will not be required to finalize a report. At a minimum, one member of the SSC’s groundfish subcommittee will be needed to conduct a review (i.e., the panel chairman). In addition, the groundfish management team (GMT) and the groundfish advisory panel (GAP) will designate one person each to participate in the review, although the GMT and GAP panelists will serve in an advisory capacity only.

Review Format

Typically, a physical meeting will not be required to complete an expedited review of an updated stock assessment. Rather, materials can be distributed electronically. STAT and panel representatives will largely be expected to interact by email and telephone. A conference call will be held to facilitate public participation in the review.

The review process will be as follows. Initially, the STAT team that is preparing the stock assessment update will distribute to the review panelists a document that summarizes the team's findings. In addition, Council staff will provide panelists with a copy of the last stock assessment reviewed under the full STAR process, as well as the previous STAR panel report. Each panelist will carefully review the materials provided. A conference call will be arranged by the panel chairman, which will provide an opportunity to discuss and clarify issues arising during the review, as well as provide for public participation. Notice of the conference call and a list of public listening stations will be published in the *Federal Register* (generally, 23 days in advance of the conference call) and a Meeting Notice will be distributed (generally, 14 days in advance). A dialogue will ensue among the panelists and the STAT team over a period of time that generally should not exceed one week. Upon completion of the interactive phase of the review, the panel chairman may, if necessary, convene a second conference call to reach a consensus among panel members and will draft a report of the panel's findings regarding the updated assessment. The whole process should be scheduled to occur within a two week period and the STAT team and panelists should be prepared to complete their work within that time frame. It will be the chairman's responsibility to insure that the review is completed in a timely manner.

STAT Team Deliverables

It is the STAT team's responsibility to provide a description of the updated stock assessment to the panel at the beginning of the review. To streamline the process, the team can reference whatever material it chooses, which was presented in the previous stock assessment (e.g., a description of methods, data sources, stock structure, etc.). However, it is essential that any new information being incorporated into the assessment be presented in enough detail, so that the review panel can determine whether the update satisfactorily meets the Council's requirement to use the best available scientific information. Of particular importance will be a retrospective analysis showing the performance of the model with and without the updated data streams. Likewise, a decision table that highlights the consequences of mis-management under alternative states of nature would be useful to the Council in adopting annual specifications. Similarly, if any minor changes to the "model" structure are adopted, above and beyond updating specific data streams, a sensitivity analysis to those changes may be required.

In addition to documenting changes in the performance of the model, the STAT team will be required to present key assessment outputs in tabular form. Specifically, the STAT team's final update document should include the following:

- Title page and list of preparers
- Executive Summary (see Appendix C)
- Introduction
- Documentation of updated data sources
- Short description of overall model structure
- Base-run results (largely tabular and graphical)
- Uncertainty analysis, including retrospective analysis, decision table, etc.
- 10 year harvest projections under the default harvest policy

Review Panel Report

The expedited stock assessment review panel will issue a report that will include the following items:

- Name and affiliation of panelists
- Comments on the technical merits and/or deficiencies of the update
- Explanation of areas of disagreement among panelists and between the panel and STAT team
- Recommendation regarding the adequacy of the updated assessment for use in management